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ether, while the organized psychic cerebrum becomes a free organism. Whether with it is freed a closely related psychic organism, the outcome of the whole body development, and reproducing every detail of the body, is a question of secondary concern. It is sufficient for our present purpose to show the conceivable separate existence of a psychic cerebrum, possessing the definite organization of the material cerebrum, and in addition all the thought conditions of the developed mind.

If the human body, as the highest outcome of its organization of energy in matter, is capable of producing such a self-centered and self-existent psychic organism, a like power, though in a lower degree, must exist in lower organic beings, and possibly in inorganic compounds. Every concrete mass which received external energies, without being molded by them, might have its bound ether molded by these energies and thus converted into psychic substance, capable of self existence when definitely separated from its nucleus. All matter may thus act as a laboratory for the elimination of psychic substance from bound ether. The freed mental organism might find an accordant sphere of existence thus prepared for it, and as thoroughly adapted to its powers and needs as the material earth is to ours. Nor could we become sensible of the existence of substance in this condition, its complete transparency to radiations of light and heat rendering it imperceptible to our senses and our instruments. Such may be offered as a speculative conception of the possibility of the existence of the mind after the dissolution of the body, in a sphere of substance suitable to its needs and powers. It is a conception towards which many partial steps have been made, but this may be offered as the first definite hypothesis of the development and conditions of the mind, based upon the conclusions of modern science.

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## SOME NOTES ON THE LIFE-HISTORY OF THE COMMON NEWT.

BY COL. NICOLAS PIKE.

THIS little reptile, our common newt or spotted eft, *Diemyctylus minimus viridescens* (Raf.) Cope, is numerous on Long Island from Brooklyn to Greenport, and is equally well known all over the Eastern States. It may be caught from March to December, as it bears a very low temperature, and I once saw it

swimming under the ice in a pond near Fort Hamilton. It is gregarious, bears confinement well, and I have often kept it for over a year in my aquarium.

Its food is very varied; it will take aquatic and other insects, small tadpoles, worms, especially earthworms, and it will eat small pieces of raw beef and fish when hungry. Though a harmless little reptile, it will quarrel occasionally with its companions about food. I have seen one seize a worm twice its own length and try to gulp it down holding it with the hands; a second would snatch up the other end and begin swallowing it till the two met. Then such a pulling and wriggling ensued, till the strongest or most persistent succeeded in making the other disgorge its meal. Sometimes it would take nearly a day before the worm vanished, the first part having to be digested before the last could be swallowed. In confinement they should have only the smallest worms, as the large ones disagree with them, and I have often had them die after one of these gorging meals. They are very fond of the small fresh-water bivalves so abundant in most of the ponds they frequent. Many are swallowed whole; one I dissected had four—shells and all—in its stomach.

When caught the little harmless creatures do not try to escape but hang limp in the fingers.<sup>1</sup> They are, however, as cunning as all the rest of their race. I placed one on my table to examine it, when it crawled under a sheet of paper and crouched down as if asleep. I was called away for a few minutes, and on my return found my little friend had absconded. Now it had not attempted to move for over an hour in my presence, but was evidently at once conscious of my absence. It was sometime before I found it on the opposite side of the room, it was so nearly the color of the carpet. It never does to trust to the apparent helplessness of any animal, for what it lacks in outward means of defense it is sure to make up in cunning.

I accidentally found out one of this animal's most deadly enemies. I once brought home a lot of the *viridescens* in a box of leaves in which I had thrown some wire-worms, thinking they might serve as food, they were so abundant around the pond. The next morning I found my poor little prisoners had all been

<sup>1</sup>Sometimes they emit a faint cry, but this is generally in the breeding season. It is a faint squealing sound not unlike that made by the *Spelerpes ruber*, but not so loud, and is I believe only heard from the males.

attacked by the wire-worms, pieces of flesh being eaten out of their living bodies. One had coiled so tightly round its victim it was paralyzed and died directly I removed it. Though so abundant, yet large numbers when young are devoured by the strong larvæ of the *Amblystoma punctatum*; the robust frog tadpoles also mercilessly nip off their gills and tails, and they soon die. These facts I have often witnessed in my aquarium.

Everyone knows these pretty olive-backed newts, yellow underneath, the whole body and tail spotted black, and on the sides a row of flame-colored spots encircled black, but everyone does not know, and perhaps never saw the change that takes place on the approach of spring, when the males assume their brightest dress preparatory to courtship. Over the back and tail waves a graceful spotted crest, the color underneath changes to orange, and the inner side of the legs is deeply barred jet black—all of which last during the breeding season and then the crest is absorbed, the black bars and bright color fade out till the next love time of the year calls them forth.

I believe this animal is incapable of reproduction under four years of age, for its growth is very slow even in its natural state. When the love-making commences there is a busy time amongst the denizens of the ponds. The males dart about, gyrating round their chosen mates, heading them off in their endeavors to escape, and when they have at last won the victory they seize the females round the lumbar region and remain thus often for hours. The milt and ova pass simultaneously, and the operation takes some time, but it is generally accomplished under cover of darkness. The older females often deposit 150 to 300 eggs at a time, which they attach to twigs in the water or long grass. The eggs are very small at first but rapidly swell. Younger females only lay from twenty to fifty eggs in a small group.

I am not aware of any one having published any account of the hatching of the eggs of *D. viridescens* except Professor A. E. Verrill, who, in the AMER. NATURALIST for 1870, wrote as follows: "The eggs of the common water newt were observed by Mr. S. J. Smith and myself at Norway, Maine, in '63 and '64, attached in round masses, two or three inches in diameter, resembling frogs' eggs, on stems of water plants in ditches in a meadow. The eggs were found May 5th, and reared by Mr. Smith, hatched May 17th, and by October 1st were one and a half inches long. They

had stout bodies and broad heads, and still retained their external gills, though they had partially acquired the colors of the adult. The experiment was then discontinued but the specimens all preserved."

This only came under my notice in October, '84, when I was delighted to find Professor Verrill's statement verified my own experience, which I will now relate :

On the 6th April, '84, a quiet cool morning, whilst sweeping my net in a pond at Jamaica ridge, I detached some bunches of ova from several dead branches that lay in the water. They varied in size from two and a half to six inches in diameter, containing from 25 to 150 eggs each, all enclosed in a glairy mass. The eggs were brown above, pale beneath, each in a greenish double envelope, but so transparent that the development was distinctly visible.

This is a most perfect arrangement for the protection of the ova ; a space lies between the envelopes and each can be separated in its own globe of glaire from the rest. These coverings are tough and not easily injured, and so firmly attached to the branch I had difficulty in loosening the whole without breaking it up. It would take a very strong wind or current to dislodge these carefully protected embryos.

They were all deposited on the south side of the pond where the sun shone in between the trees, about six or eight inches below the surface, in very clear water. I brought them home in a pail of water and placed them in an aquarium. I prepared for them with aquatic plants and débris from the pond. I thought I had secured the spawn of the *A. punctatum*, not thinking of *Diemyctylus*, which is mostly accredited with depositing one or two eggs separately in a folded leaf. From the appearance of the ova some must have been laid the preceding night, while others showed a curious mass of small granulations.

In a few days a sort of break up of some of the ova took place, if I may so express it. The embryo assumed a fish-like appearance with a blunt head, curled up tail and a thick solid body. During the next fourteen days the brown body enlarged, head was very dark, outline of eyes visible, snout broad and thick and if shaken the little creature displayed considerable irritation by a twitching of the tail. By the 20th the body was elongated and curved, the flattened tail showing a fin, the verte-

bral striæ and branchiæ with the minute claspers all were visible with a good glass. The glairy coverings enlarged with the creature's needs, and by the 28th some had emerged and commenced life on their own account. On the 9th May the film disappeared from the eyes, the gills were free, and what seemed to be thin white threads were really the first appearance of the anterior legs, but only by the aid of a powerful glass could the two little claw-like fingers be seen. A dark stripe showed from nostril to eyes and another on the head, and the whole body was covered with fine dottings.

It is very difficult to know what is the food of these mites, at this stage only half an inch long. It can only be the minute monads and confervacious spores in the water. The glairy envelopes remained long without decomposition, intact but for the cleft by which its occupant emerged. I am half inclined to think the young still feed on them, for they hang round them constantly; I know frog and toad tadpoles will feed greedily on these empty shells.

The little newts would remain motionless for a long time as if dead, but if disturbed would rush madly round. The whole of the ova did not hatch till the middle of May, so the first out must have been laid in March. By the 15th there was little doubt in my mind that I had at last solved the problem of the spawning of the *Diemyctylus*. The reddish gills were well fringed, the eyes prominent, the front legs transparent and white fingers free, the abdomen shewing the viscera, and the body dotted all over. A dark stripe from snout to eyes is, I find, never absent in the larva of this species.

On the 25th I procured a quantity of *Lemna* or duckweed for my aquarium, and it spread all over the surface of the water. My little pets delighted in it, and when the sun shone they would crowd under it in every position, seeming to hang on to the slender roots.<sup>1</sup> They certainly thrive in their leafy home, and flourished so well that in a month, on the 25th of June, they were an inch long, very active, brownish-gray in color, with a series of whitish markings where the spots were to appear later. The abdomen alone was spotless. Two fingers and two knobs showed in front, and the hind legs were out but the feet only slightly

<sup>1</sup> Possibly the *Lemna* contained minute spores, or ova of insects, which served them as fresh food.

developed. The young begin to molt in confinement about the second month; later on, with every change, the spots which are only blurred white markings at first, assume a more definite shape. The adults change their skin frequently when they have abundant food, which has the same effect on the Urodela as on the ophidians.

Thus far all went well, but then began the great trouble always experienced at this stage in rearing the Urodela, much greater than that of the Anura. The latter will feed greedily on decomposed animal matter that the former seem to care little for, in confinement at least. I tried every kind of aquatic plant and small insect I could get from the ponds, but uselessly, many died and the rest were thin as shadows but active as ever. A few survived till August and well proved their identity, when I put the last but one in *spirits to save its life!* The last I kept alive till nearly the end of the month by feeding it on little red mites that swarm in the ponds at that season, but even it succumbed, and it was still only one inch long when it followed its mates, never having grown since June. I preserved a series of specimens from the spawn upwards, and I hunted the ponds so persistently that I was able to supplement my own deficiencies by larvæ from them in every stage, so that now it is complete in my cabinet from spawn to a fine adult five inches long.

To show the difference in rearing these animals in confinement and in their natural state, I will mention that on June 14th I took some larvæ from the same pond over two inches in length and quite fat. Doubtless the great increase of size over mine was due to abundance of suitable food, fresh air and abundant room to swim about in. I have had ample proof that the breeding season extends even to May, from the very small larvæ I have taken even in July.

Some young taken in September were a dark olive, the tail nearly black and feet dark; those of October showed a little dotting on the chin; those of November had the gills absorbed, were about two and a half inches long, and were sparsely dotted underneath, but the side spots still white. I do not think the flame color always comes in till the second year, and the buff color of the abdomen shews about the same time. As the animal nears the period when the gills completely disappear, its body diminishes in size, and I have taken some in the second

year on land barely two inches, tail included. The atrophy of the branchiæ begins at the extremities and goes on very gradually till the fimbriæ are absorbed, when the rest roll up and leave two rounded tubercles that I have still found in specimens taken in December just before hibernation.<sup>1</sup> As the gills are absorbed the form of the head changes. During their growth it widens considerably in front of them, but on absorption the neck becomes narrow, and between the eyes it is broader. The fin, round back and tail vanishes at the same time.

Both sexes leave the water after the mating is over for a time, and hide, without feeding, under stones and tussocks. The young of the second year sometimes leave the water for months together and secrete themselves in damp places. When droughts occur and the ponds dry up I have often dug them out, all huddled together, more than a foot below the surface, and where the clayey ground has become so parched that they are unable to burrow they are often seen several together, dead and dried up.

This season, 1884, an exceptionally mild one, I took, on a bright warm day early in December, quite a number of large *viridescens*, both male and female, very active although there was a thin coating of ice on the pond. The former had the legs already barred and the tails finned, while the latter were large and fat. I dissected a female and found her full of good-sized ova.

*Diemyctylus mineatus* (Raf.) Cope (Eastern water newt).—This little animal, formerly supposed to be distinct from the last described, and mentioned in the latest bulletin of the Smithsonian Institution, is now generally acknowledged to be only a color variety of the *D. viridescens*. Dr. Hallowell was the first to express his belief that the so-called distinct species were the same. Professor Cope<sup>2</sup> says, "the nominal *D. miniatus* is a state of *D. viridescens*," and that he has had it change to the latter in confinement.

Mr. Howard A. Kelly, in an article in the AM. NATURALIST, states, "he brought home a number of *D. miniatus* (Raf.) or little red lizard or red eft, and after keeping them in a dark box filled

<sup>1</sup> These animals do not, I believe, really hibernate in the usual acceptance of the term, that is, they do not often become dormant. In January and February, when the ponds are frozen over, they resort to the deep holes, where they remain huddled together, if not disturbed, till the genial sunshine again calls them forth to activity.

<sup>2</sup> Professor Cope has studied the Urodela perhaps as much and as carefully as any one in this country, and is therefore an undoubted authority on the subject.



with saturated moss, they changed their color from a bright vermillion to the olive state characteristic of the *D. viridescens*," and he kept them all winter.

I have gradually come to the conclusion that the two are identical. Some years ago I captured quite a number of red ones in the Catskill mountains, brought them home and kept them in a box with other salamanders, where they could resort to water if they chose. For some days they remained hiding under the wet moss and stones, but finally crept out at night and went into the water. I gave them insects and worms, which they readily devoured. In about three months they lost their bright red, and in less than a year they were of the usual olive of the *viridescens*.

Another fact still more decidedly bearing on the case, is, that some two year old olive-colored *viridescens* taken from the ponds and put in earth and dead, wet leaves in a tub in my garden without water, in a month or so began to lose their green tint and assume a dingy brownish hue.

It is well known that the *Diemyctylus* often stays away from water for months at a time, but roams round at night in the damp earth and grass in wet weather.

The food these animals take plays also a very important part in their coloration and growth, just as we see in the whole animal kingdom. In the ponds the *viridescens* is generally a dull olive, almost the color of the green slime and plants covering them, in which they hide almost unseen. On land, where they are always in the day time, either under stones or dead wood or in the earth they have burrowed in, they assume more the color of these objects to hide from whatever enemies they may have in their new habitat.

Then as to food; in the water they have abundance of succulent nutriment — mollusks, tadpoles, ova of reptiles and fish, aquatic insects and plenty of confervaceous plants on which they and their prey alike feed, and which doubtless assists in their coloration. Now as soon as they leave the water their food changes at once to spiders, insects, earthworms, &c., so totally different from the prey of the ponds, and it is most probable this is the first cause in the change of color in the little *Diemyctylus*.

Locality has also considerable to do with the tints of the skin in these animals, as we see so prominently in snakes, especially

in the genus *Eutænia*, where difference of locality has had such an effect on the coloration as to give rise to several species being made out of the common garter snake.

I have procured these newts from many places in New York and New Jersey States and different parts of Long Island, of every shade of red up to very bright scarlet, yet within a radius of many miles from Brooklyn, where the *viridescens* and its variety are both plentiful, I never find the latter other than a reddish-brown, varying from light to very dark. Sometimes late in December I find little brown ones with flame-colored spots, in the ponds. These are so greatly attenuated it is possible they have returned to the water in search of food, lacking on land, at so late a period when all animal life which would be available for them disappears from the surface.

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## THE RELATION OF THE PECTORAL MUSCLES OF BIRDS TO THE POWER OF FLIGHT.

BY CHARLES L. EDWARDS.

OF all the modes of animal locomotion flight is the most rapid, the most graceful, the most fascinating. With one important exception this power separates the bird from the other vertebrates and gives it preëminence in motion. Its whole structure—the conical form of the body offering so little resistance to the air, the hollow bones, the air-sacs and the weaving together of the smallest barbules to form the close web of the wing—all denote that in the air, in flight, is the bird's life.

While in a very general way much has been observed with regard to the variation in the power of flight of species differing quite widely from each other, yet there are still some unsolved problems connected with the highest form of motion.

Before attempting the solution of any special problem there are certain mechanical elements of flight with which we must become familiar.

A body much heavier than air is to be propelled with great speed through the air. The resistances are the force of gravity and the air itself.

The perpendicular action of the broadly expanded wings opposes as much as possible the force of gravity, while the narrow